Technical Literature

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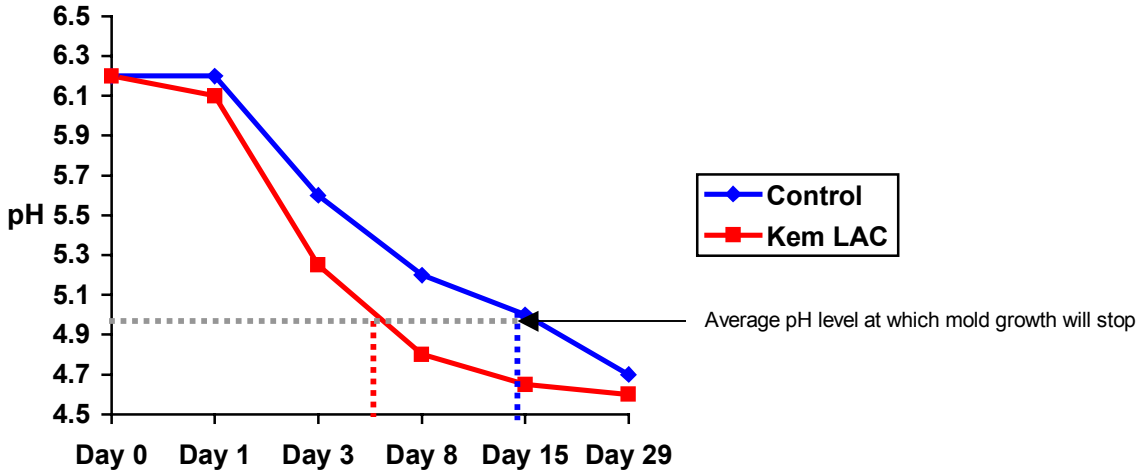
Silage Additives: An Insurance Policy for Your Forage Investment

Help preserve your forage investment through the use of silage additives. Silage additives have been found to improve fermentation, reduce heating, reduce mold and storage losses, and improve the nutritive value and digestibility of forage. However, the quality of the fermented forage in the end is not the time to evaluate if a silage additive has worked effectively. A silage additive's main benefits are what occur during fermentation and prior to the silage becoming stable.

Effect of Kem LAC® brand Silage Inoculant on pH Reduction of Alfalfa Haylage*



*Data on file at Kemin Americas, Inc.

The figure above demonstrates the effect of Kem LAC silage inoculant on the change in pH of alfalfa haylage over time. It is important to note the reduction in pH of the haylage is more rapid with the use of Kem LAC silage inoculant. This increased rate in pH reduction is due to the inoculation of *Lactobacillus* organisms. These organisms produce lactic acid, which is the strongest of the acids found in silage. As the number of lactic acid producing bacteria increase, more lactic acid is produced; therefore, decreasing the pH in the silage. This is very important in the production of silage since one of the goals in silage production is to decrease the pH as rapidly as possible. Once the pH level reaches 5.0 or lower, the silage becomes stable and growth of unfavorable molds and bacteria are inhibited. The figure above shows the haylage treated with Kem LAC silage inoculant reached its stable state by approximately day 5; however, the untreated haylage did not reach its stable state until approximately day 15. This means the untreated haylage maintained an environment favorable for mold growth for an additional 10 days.

Another silage additive from Kemin Americas, Inc. is Silage SAVOR® brand silage preservative. Silage SAVOR silage preservative is an organic acid preservative that can be applied to silage in either a liquid or dry form. Organic acid preservatives, such as Silage SAVOR silage preservative, assist in promoting proper fermentation of silage through direct acidification, thus inhibiting particular bacteria that are detrimental to silage fermentation. In addition, Silage SAVOR silage preservative quickly reduces the pH of the silage, which provides an ideal growth environment for lactic acid producing bacteria. Therefore, helping achieve stable silage in a shorter period of time.

When a Kemin Americas, Inc. forage preservative is used, a team of highly trained personnel is available to assist you in producing the highest quality forage possible.

CAUSE AND EFFECTS OF PROPER AND IMPROPER SILAGE FERMENTATION

Dry Matter/Moisture
- Moisture has the greatest impact on fermentation
- High moisture may lead to prolonged fermentation, excessive protein breakdown, and too high of an acid level
- Low moisture may lead to unstable forage and yeast and mold problems

pH (Acidity)
- The lower the pH, the better the silage is preserved
- Corn silage usually has a pH below 4.2
- High pH can be caused by dry, drought stricken corn
- Legume silage may have a pH from 4.6 to 4.8
- Ensiling haylage at less than 30% DM may cause clostridial fermentation
- Ensiling haylage at more than 45-50% DM may restrict fermentation

Other Reasons for High pH
- Sampled before complete fermentation
- Cold and/or wet weather during harvest
- Slow fill, poor packing, or large particle size
- Legumes with extremely high ash content (>15% of DM)
- High protein levels (>24%)
- Ammonia or urea used to treat silage
- Clostridial silage
- Spoiled or moldy forage at harvest
- Silages containing manure or soil

Lactic Acid
- Has no smell
- Strongest silage acid and drops pH most rapid
- At least 60-70% of total acids should be lactic acid
- Fermentation which result in lactic acid production usually result in lowest DM and energy loss
- Low lactic acid levels may result from dry silage, ensiling in cold weather, sampling after lactic acid has been degraded by air exposure, or high butyric acid levels

Acetic Acid
- Smells like vinegar
- Extremely volatile silage acid
- Produced in wet silages (<25% DM)
- Prolonged fermentations
- Caused by slow fill, loose packing, large particle size
- Levels >4-6% reduce intake, DM, and energy recovery

Butyric Acid
- Smells rancid or fishy
- Levels >0.5% indicate clostridial fermentation
- Silages are lower in nutritive value, with higher ADF and NDF
- May have higher levels of soluble proteins
- Silages high in butyric acid can sometimes cause more incidences of ketosis

Ammonia
- Has characteristic smell
- High levels (>12-15% of CP) indicate poor or extensive fermentation leading to excessive protein breakdown
- Produced in high moisture silages
- Caused by slow fill, loose pack, large particle size

Ethanol
- Smells sweet
- Yeast converts sugars to alcohol and metabolize lactic acid, which will raise pH and lead to unstable silage
- Yeast growth is caused by slow feed out, loose packing, slow filling, and large particle size

Tobacco/Molasses
- Smells like tobacco or molasses
- Produced by excessive heating during fermentation
- High heat (above 100° F) can cause browning (Maillard) reactions to occur, which bind proteins to carbohydrates and make both unavailable to the animal
- Silages with high DM (>45-50%) most suspect
- Caused by slow fill, loose pack, large particle size

FORAGE SAMPLING PROCEDURES

Large variation in nutrient content and feeding value can exist with forages. Therefore, to ensure the most accurate analysis for forages, the correct sampling procedures and techniques should be followed.

1. Identify variations in forage by “lots”. A lot is hay or silage taken from the same location, same cutting at same maturity, similar amounts of rain damage and preservative treatment, and similar in physical characteristics and mold condition.

2. Take a representative sample of the entire lot. For hay, take 10-20 core samples with a core sampler. Grab samples of hay do not provide uniform samples: the samples are biased and there usually is a large amount of leaf loss. For silage, take 10-20 grab samples. Take the samples from various locations across the face of a bunker silo. Exercise caution when taking these samples to ensure that no silage falls on top of you. One may consider removing a small amount of silage from across the face with a front-end loader to prevent these types of accidents.

3. Mix the hay core samples or silage grab samples together in a bucket. The mixed sample sent for analysis should be approximately 1 pint to 1 quart for hay and 1-2 pounds for silage. Place the samples in clean, heavyweight plastic bags and seal the bag to ensure moisture content is maintained.

4. If silage samples are taken throughout the day, samples need to be stored in a cool place. Do not freeze samples if mold and yeast tests are to be conducted. Always ship silage samples with ice packs to ensure no mold growth occurs during shipping.

5. Never ship samples before a weekend or holiday, and always ship samples next day delivery.